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Abstract

This paper presents an acoustic study of High Vowel Lowering in Apurímac Quechua dialect of Peru. High Vowel Lowering in the vicinity of uvular stops has been reported in related dialects of the Quechua language family (Quechua IIC category), e.g. Cusco and Cochabamba Quechua. Initial impression of Apurímac Quechua also indicated a lowering effect of high vowels after uvular stops, which motivated the current study, where we compared the high vowels following uvular stops to high vowels following alveolar stops. Considering the fact that prosodic phenomena such as word and phrasal prominence, i.e. stress and focus may resist the erosion of contrastive features or enhance the contrastive features of segments, it is possible that the high vowels would not undergo lowering in the presence of stress or focus or both. Hence in addition to testing the effect of the place of articulation of the preceding consonant on high vowels, this study also tests the effects of stress and focus on the lowering process. While the results show that stress resists High Vowel Lowering, focus does not lend the same effect.

Prosodic Prominence and High Vowel Lowering in Apurímac Quechua

Sreeparna Sarkar and Irene Vogel

1 Introduction

Apurímac Quechua (ISO 639-3 *qve*) is a Southern Peruvian dialect originating in the Apurímac region of Peru. It belongs to the Quechua IIC category (Torero 1974:446), and like other dialects of this category such as Cusco, Puno and Bolivian Quechua (Cerrón-Palomino 1994), Apurímac Quechua exhibits a three-vowel system, /i, u, a/ in native words. Mid vowels, [e, o], are also observed, especially in loanwords from Spanish, however, their phonemic status in the dialect is currently controversial.

A preliminary observation of the Apurímac dialect has also indicated the presence of the mid vowels ([e] and [o]) after uvular stops in native Quechua words. In addition, previous studies of related dialects, such as Cusco (Molina-Vital 2011) and Cochabamba Quechua (Gallagher 2016:101) have also reported lowering of the high vowels (/i/ and /u/) in the vicinity of uvular consonants. The impressionistic observation of [e, o] after uvular stops and the previous reports of the occurrence of mid vowels in other related dialects, motivated the current investigation in which we systematically test whether high vowel lowering applies after uvular stops in Apurímac Quechua as well.

Given that prosodic phenomena often interact with segmental patterns, we also consider the effects of stress and focus on the manifestation of the vowels in question. Since it has been observed that word and phrasal prominence (i.e., stress and focus) may enhance the properties, or resist the erosion, of contrastive features (Remijsen 2002), we consider whether the high vowels are less likely to undergo lowering in the presence of stress and/or focus. Thus, in addition to testing the effect of uvular place of articulation on the high vowels, we also test the effect of prosodic properties on this possible lowering, and in particular, whether high vowels in positions of prosodic prominence exhibit less lowering adjacent to uvulars than the same vowels not in positions of prominence.

2 Apurímac Quechua Phonemes

Since Apurímac Quechua is an understudied dialect, not much information about its phonemic inventory is currently available. Based on the orthography, as well as preliminary observations, it was found that the vowel inventory consists of /i, u, a/, illustrated in (1a-1c). Additionally, the vowels [e] and [o] may appear in loanwords from Spanish, as in (2a-2c).

Examples of vowels /i,u,a/ in native Quechua words:

- (1) a. /i/: **pichinku** ‘bird’
- b. /u/: **ñuqha** ‘I’
- c. /a/: **kunka** ‘neck’

Examples of vowel [e, o] in some borrowed words:

- (2) a. **Roberto** ‘Robert’
- b. **choclo** ‘corn cob’
- c. **tocos** ‘fermented potato dish’

The consonant inventory, while generally similar to that of other dialects, nevertheless exhibits an interesting difference from some of the other Quechua IIC dialects. That is, while the other dialects exhibit a three-way stop contrast (i.e., plain, aspirated and ejective), the Apurímac dialect appears to lack aspirated stops, resulting in a two-way stop contrast. The stop inventory of Cusco (Parker 1997) is given in Table 1, except the aspirated stop series, shaded in the table, is not pre-

sent in Apurímac Quechua.

	Bilabial	Alveolar	Palatal	Palatal voiced	Velar	Uvular	Glottal
Plain stops	p	t	č		k	q	
Ejective stops	p'	t'	č'		k'	q'	
Aspirated stops	p ^h	t ^h	č ^h		k ^h	q ^h	

Table 1. Cusco 3-way stops (from Parker 1997); aspirated stops are absent in Apurímac Quechua.

The maximal syllable structure Apurímac Quechua is CVC, however, both the onset and coda are optional. Crucially for the present study, Apurímac Quechua, like other Quechua dialects, exhibits fixed penultimate stress, as illustrated in (3); the apostrophe indicates that a syllable is stressed.

Examples of penultimate stress in Quechua:

- (3) a. 'tuma- 'mouth of a river'
 b. tu'mapi- 'in the mouth of a river'
 c. tardin-'payta 'afternoon'

3 Previous Reports on High Vowel Lowering in Quechua

An effect of uvular stops on adjacent high vowels has been reported in a number of dialects of Quechua. Specifically, lowering of these vowels has been observed in the dialects of Cusco (Pasquele 2001, Fabian 2011, Molina-Vital 2011) and Cochabamba (Holliday 2014, Gallagher 2016:101). Bills et al. (1969) and Cerron Palomino (1994) have also reported on high vowel lowering in the vicinity of uvular stop consonants in southern Quechua dialects.

The effect of different contexts (e.g., word-initial, intervocalic and clusters) on High Vowel Lowering after uvular stops was addressed in one of the studies: Molina-Vital (2011). The syllabic position of the vowels was not reported systematically, however, so we cannot tell whether stress may have been relevant (i.e., distinguishing the penultimate vowels from the others). No information about the focus context was reported in either this or the other studies. However, considering the fact that the subjects were presented with the words in isolation, the spontaneous sentences they produced may have resulted in the appearance of focus on the target word. Nonetheless, a comparison of the focus context with a non-focus context was not available.

4 Experimental Investigation of High Vowel Lowering in Quechua

Since we are particularly interested in the effect of prosody, specifically the effects of word and phrasal prominence, on the manifestation of High Vowel Lowering in Apurímac Quechua, we examined the vowels in question in relation to stress and focus. In particular, we tested three-syllable words, and compared the stressed penultimate syllable (Syll2) with the unstressed initial syllable (Syll1). In addition, we compared the manifestation of the stimuli with and without focus. The specific hypotheses we tested are:

- Hypothesis 1: Apurímac Quechua will exhibit the same High Vowel Lowering in all cases (i.e., regardless of stress and focus).
 Hypothesis 2: Apurímac Quechua will resist High Vowel Lowering in the position of lexical stress (i.e., Syll2), regardless of focus.
 Hypothesis 3: Apurímac Quechua will resist High Vowel Lowering under focus, regardless of lexical stress.

Confirmation of Hypothesis 1 would mean that Apurímac Quechua behaves similarly to the other varieties of Quechua with regard to High Vowel Lowering. Confirmation of either Hypothesis 2 or Hypothesis 3, or both, would indicate that lexical and/or sentence level prominence preserves the basic high vowels, and thus provide additional support for the role of prosodic prominence in maintaining segmental contrasts.

5 Methodology

5.1 Procedure

The corpus for the present study consists of audio recordings made in a noise-protected sound booth of the Phonetics Lab at the University of Delaware. One male, university educated, native speaker (age 31 years old) of Apurímac Quechua was recorded. In addition to being a native speaker of Apurímac Quechua, the speaker is bilingual in Spanish and fluent in English.

The stimuli were presented as short dialogues by means of PowerPoint slides. They appeared in randomized order and were recorded using PRAAT. The speaker was instructed to read both the question and the answer in the dialogues. The dialogue slides were separated by distractor items (i.e., images of various objects the speaker had to name), in order to avoid repetitive intonation patterns.

5.2 Stimuli

Stimuli were real three-syllable CVCVCV words, although in some cases, CVC appeared in a non-target syllable. Since we were interested in the effect of uvular consonants on the target vowels, we used, as a control pattern, onsets with an alveolar stop /t/ as the onset; see examples in Table 2.

Target syllable	Uvular onset		Alveolar onset	
	/i/	/u/	/i/	/u/
Initial (Syll1)	q iquna ‘stupid person’	q urata ‘vegetables ACC’	t inaja ‘bowl’	t umapi ‘in the mouth of a river’
Penultimate (Syll2)	ch' a qita ‘soup ACC’	q iquna ‘stupid person’	sut i ta ‘name ACC’	kh i tuta ‘clumsy ACC’

Table 2. Examples of stimuli with uvular and alveolar onsets.

Both /q/ and /t/ were followed, in the two syllable positions, by 10 instances of each of the vowels, /i/ and /u/. All of the targets were well-known native Quechua words. As noted above, the penultimate syllable is the stressed syllable; the initial (antepenultimate) syllable was used for comparison with an unstressed syllable. The last syllable is also not stressed, but it was not included here in order to avoid possible additional effects of its final position.

The stimuli were embedded in two short dialogues, one priming a reading with focus on the target (Focus Condition), the other with focus on a word after the target (Non-Focus Condition); total =160 targets. The structures are illustrated in Table 3, where the target is in quotation marks, and the focused word is bolded. Only the target words appearing in the answer of the dialogues were used for the analysis, following the protocol of the Prosodic Typologies Lab at the University of Delaware.

Focus Condition	Q: ¿Imatataq Maria kutiparan kunam illariypi?	A: Maria “ q iquna” kutiparan kunam illariypi.
	‘What did Maria repeat in the morning?’	‘Maria repeated “ q iquna” in the morning’.
Non-Focus	Q: ¿Maria “qiquna” rimapakuranchu tardinpayta?	A: Manam, Maria “qiquna” k utiparan tardinpayta, chaymantaq manaña kaytar_rimapaku-

Condition		ranchu.
	‘Did Maria whisper “qiquna” in the afternoon?’	‘No, Maria repeated “qiquna” in the afternoon, she did not whisper it’

Table 3. Carrier dialogues.

5.3 Analysis

All of the data was segmented manually using PRAAT (Boersma and Weenink 2019). The target vowels were identified by the presence of a consistent periodic waveform. In an initial analysis, vowel height and (front/back) position were determined by plotting F1 against F2, following the method used in previous studies of High Vowel Lowering. Since one of the vowels, /u/, also involves lip protrusion that tends to cause formant lowering in general (Fant 1975:1), the vowel positions were examined additionally by plotting F2-F1 against F1, the measure used in our presentation and discussion of the results.

6 Results

Figure 1 shows the vowel plots calculated as F2-F1 against F1 for /i/ and /u/ after the uvular stop /q/ and alveolar stop /t/ overall. The values for a generic /a/ are included for vowel height reference.

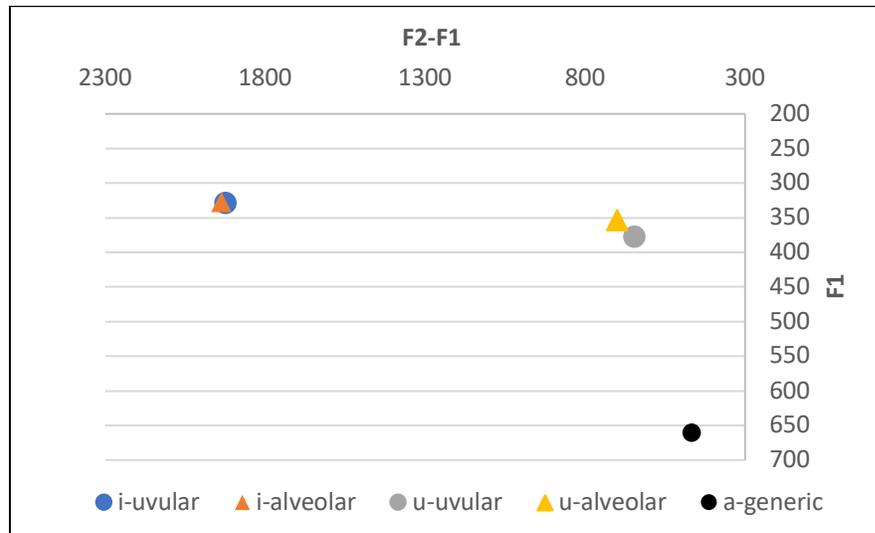


Figure 1. Overall position of /i/ and /u/ in the vowel place following uvular and alveolar stops, with the position of generic low vowel /a/ in the vowel space for reference.

As seen in Figure 1, there is no evidence of High Vowel Lowering when the prosodic stress and focus conditions are pooled. The height of /i/ following the uvular stop is same as the height of /i/ following the alveolar stop. Similarly, the height of /u/ following the uvular stop is essentially the same as that following the alveolar stop.

Let us now consider the effect of stress on the vowel. Figure 2 shows the vowel plots for /i/ and /u/ after the uvular stop /q/ and alveolar stop /t/ in unstressed vs. stressed syllables (Syll1 vs Syll2), with a generic /a/ for reference.

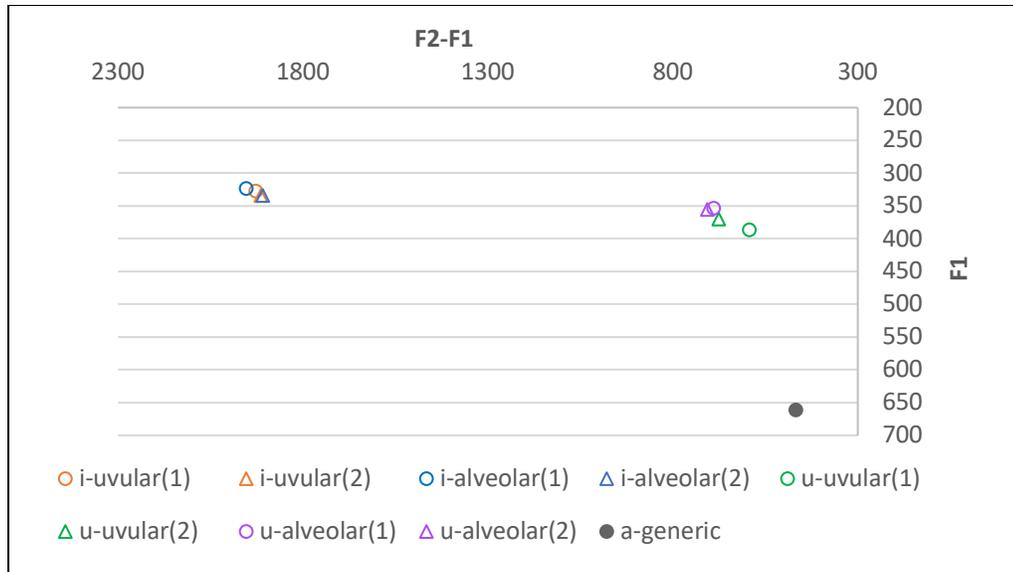


Figure 2. Vowel position of /i/ and /u/, after uvular /q/ and alveolar /t/ in stressed (penultimate) syllable (2) and the unstressed (initial) syllable (1) compared to the position of a generic low vowel /a/ in vowel space.

As Figure 2 indicates, there is an overlap of /i/ in both syllable positions. In the case of /u/, however, we do find evidence of lowering after the uvular stop /q/ when compared to the alveolar stop /t/ in the unstressed syllable (Syll 1). By contrast, there is considerable overlap in the stressed syllable (Syll2).

Turning next to the effect of focus on High Vowel Lowering, Figure 3 shows the vowel plots for /i/ and /u/ after the uvular stop /q/ and alveolar stop /t/ in focus and non-focus conditions.

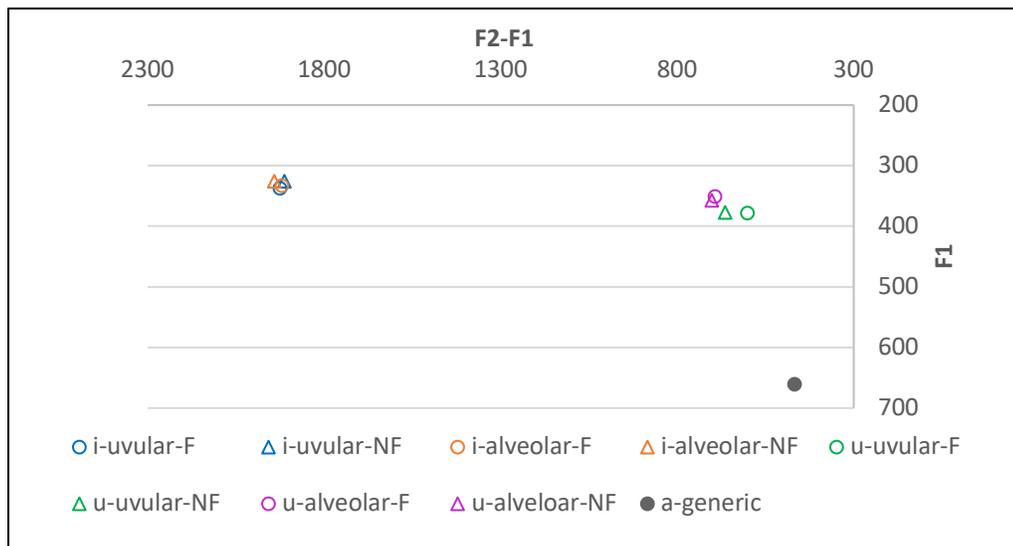


Figure 3. Positions of /i/ and /u/ in the vowel space, after uvular /q/ and alveolar /t/ in focus and non-focus conditions, compared to the position of a generic low vowel /a/.

As can be observed in Figure 3 the vowel plots for /i/ and /u/ after the uvular stop /q/ and alveolar stop /t/ in focus and non-focus conditions (F vs NF) show an overlap of /i/ in both the focus

conditions. In the case of /u/, we observe some lowering in both focus conditions, however, the lowering is minimal, and is essentially the same the two conditions.

7 Discussion

When our results are pooled, we do not see any evidence of High Vowel Lowering, which is contrary to the findings for other dialects (Cusco and Cochabamba Quechua). This result disconfirms Hypothesis 1 which predicted that Apurímac Quechua would exhibit High Vowel Lowering in all conditions. When we consider stress, however, we observe that the unstressed syllable does exhibit High Vowel Lowering, while the stressed syllable resists it. This confirms Hypothesis 2, which predicted that Apurímac Quechua would resist High Vowel Lowering in the position of lexical stress due to the effect of prominence in this position. Focus prominence does not, however, lend the same strengthening effect, since both focus conditions show a similar (weak) effect on High Vowel Lowering. Thus, we disconfirm Hypothesis 3, which predicted that Apurímac Quechua would resist High Vowel Lowering under focus.

It must be noted, however, that, when considering our findings in the context of the previous studies on Cusco Quechua (Molina-Vital 2011) and Cochabamba Quechua (Gallagher 2016: 101), any comparisons may only be taken in the broadest terms. That is, we cannot directly compare our findings with those of other studies since they did not specifically control for different prosodic positions as we did. Moreover, the High Vowel Lowering in the other dialects was determined by plots of F1 against F2, while we plotted as F1 against F2-F1 to compensate for the possible effect of lip protrusion and the resulting lengthening of the oral cavity with the back vowel /u/ (Ladefoged 1996).

Finally, considering the perception of the vowels, Gallagher (2016) found that vowel height was used as a cue to the uvular-velar place contrast by the listeners. It seems possible that when velar consonants are used for place of articulation control, speakers may exaggerate the vowels in order to increase perceptibility of the velar and uvular contrast, which may otherwise be somewhat difficult to maintain and detect. In this case, a larger acoustic difference may also have been observed between the high vowels in the vicinity of the uvulars compared to the high vowels in the vicinity of the velars in the corresponding production data, if the speakers were exaggerating the contrast between the consonants by changing the vowel quality. When the contrast is between uvulars and alveolars, the acoustic difference between the high vowels is not as crucial since the consonantal place of articulation contrast is more evident.

8 Conclusion

Our findings demonstrate that at least in Apurímac Quechua, High Vowel Lowering is sensitive to lexical stress prominence. The stressed syllable resists High Vowel Lowering while the unstressed syllable allows High Vowel Lowering. Focus prominence does not have the same effect as stress. Although focus also introduces a type of prominence, we did not observe a meaningful difference in vowel height in comparing the focus and non-focus contexts. That is, focus does not appear to affect High Vowel Lowering as stress does.

With regard to the other Quechua varieties, for a more reliable comparison, it would be necessary to test similar prosodic (i.e., prominence) distinctions. Since the previous studies did not consider different prosodic contexts such as stress and focus prominence, the results cannot be systematically compared.

Moreover, it would be interesting to systematically test the possible effect of using a more or a less similar place of articulation for the control consonant. We would thus be able to determine whether our results differed consistently from those of the studies using a velar (vs. our alveolar) onset. That is, we would be able to further assess whether High Vowel Lowering is less clear in a contrast involving the alveolar place of articulation, which is itself easier to distinguish from the uvular, without reinforcement from the vowel height.

Finally, it is important to consider which measurements are crucial for the comparison under investigation. That is, we suggest using, as we did, F1 vs. F2-F1, rather than F1 vs. F2, in order to avoid the potential effects that lip rounding and protrusion have on the formants of one of the high

vowels tested, /u/.

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